Isolation and characterization of compound from Ambrosia artemisiifolia

ISOLATION AND CHARACTERIZATION OF ALLELOPATHIC COMPOUND FROM AMBROSIA ARTEMISIIFOLIA

F. Molinaro, C. Mozzetti Monterumici, M. Negre

DISAFA Department of Agricultural, Forest and Food Sciences,University of Turin, Grugliasco, Italy

Summary

1) Concerns about environmental involvement and insurgence of resistant weeds are moving the attention from chemical herbicides to new solutions. /

2) As a consequence of the consciousness of the environmental impact of agrochemicals and the insurgence of resistant weed species, alternative weed control technologies became the new pathway to explore / in which research may proceed.

Natural compounds from plants offer excellent potential for new herbicidal solutions, or lead compounds for new herbicides. Nowaday, research on allelopathy and allelochemicals could provide natural molecules that could be useful in the agricultural weed management (Vyvyan 2002).

In this work, we extracted and isolated a compound with herbicidal action from *Ambrosia artemisiifolia* L., with the purpose of identify and characterize it. Germination tests with radish and cress seeds are used for evaluate the inhibition and a method for purification and fractionation has been developed for studying the effect of different compounds and individuate the main responsible of the inhibition. Analysis by LC-UV, LC-MS/MS, GC-MS and LC-HRMS have been carried out for the characterization of extracted compounds.

The general aim of the project is to identify a potential natural herbicide and explore its possible applications in the context of weed management and pests control.

Introduction

In last decades the consciousness about the environmental impact of chemicals, used in agriculture for the control of pests and weeds, has resulted in a worldwide interest in more eco-friendly technologies and less-persistent compounds, for the protection of soils and waters. Allelopathic plants may be considered a potential source of new molecules with herbicidal action to be used in biological agriculture.

Ambrosia artemisiifolia or common ragweed, is an annual weed indigenous of North America now widespread in Europe and Asia, note for the invasiveness in urban areas and crop fields–[1]. Many studies revealed the allelopathic potential of this weed in experiments with crops and weeds, in field and greenhouse conditions [2]. Nevertheless the nature of the phytotoxic molecules present in A. *Artemisiifolia* has not been fully investigated.

The aim of this work was the identification and isolation of allelochemicals deriving from *A. artemisiifolia*, to explore the applications of these bioactive molecules as natural herbicides.

Materials and Methods.

Ragweed plants collected on the campus of the Department (Grugliasco, Italy) have been extracted with different solvents. The phytotoxicity of the crude extracts was assessed by germination tests conducted on cress and radish.

Purification of the crude extracts aimed to separate the active compounds was performed by liquid/liquid extraction and liquid chromatography.

The identification and quantification of the active molecule was performed by LC-MS/MS, GC-MS and on HPLC-HRMS (Thermo LTQ Orbitrap).

Results and Discussion

Methanol crude extracts of *A. artemisiifolia* have shown to inhibit the germination of radish and cress. Further separation of the methanol extracts into different polarity fractions has allowed isolating a phytotoxic fraction containing a single molecule able, even at low concentration, to completely inhibit cress and radish germination. The active molecule had a molecular weight of 260.--.D and formula $C_{15}H_{16}O_4$. Its concentration in the plant was in the order of magnitude of 100 mg Kg^{-1} and it was not strongly affected by the seasonal variation. The active molecule was mainly present in the leaves (> 80 %) while less than 10 and 5 % respectively was found in the stem and in the roots respectively.

Conclusions

The active molecule extracted from *A. artemisiifolia* has given promising results as potential natural herbicide at laboratory scale. Further studies are being conducted in order to assess its field behavior, mainly as far as its persistence is concerned.

References

[1] P. Gladieux and T. Giraud et al., “Distinct Invasion Sources of Common Ragweed (Ambrosia artemisiifolia) in Eastern and Western Europe”, Biological Invasions, 13 (4), pp. 933-944, Springer, 2011.

[2] F. Vidotto, F. Tesio and A. Ferrero, “Allelopathic Effects of Ambrosia artemisiifolia L. in the Invasive Process”, Crop Protection, 54, pp. 161-167, Elsevier, 2013.